Which skills protect graduates against a slack labour market?

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Abstract. *This article explores the relationship between graduates' skills and their risk of over-education and unemployment in 17 European countries. Distinguishing between field-specific and academic skills, the authors find that, as predicted by the crowding-out hypothesis, field-specific skills offer more protection against the risk of over-education when the excess labour supply in the occupational domain of the graduate's field of study increases. Conversely, academic skills have that effect when excess supply in the overall labour market is higher. Field-specific skills also protect graduates against the risk of unemployment, whereas graduates' level of academic skills appears to be unrelated to the risk of becoming unemployed.*

Several studies have analysed the cyclical crowding out of low-skilled workers by high-skilled workers.[1] In general, their findings suggest that having a higher level of education protects workers against unemployment in slack labour markets: when overall labour demand decreases, higher-educated workers will enter the jobs previously occupied by lower-educated workers and these in turn will face a higher probability of becoming unemployed. While previous studies have focused on workers with different levels of education, we expect the same mechanisms to lead to competition for jobs among workers with the same level of education but different skill endowments. Workers with the lowest skill endowments within their level of education are the least likely to secure a job which requires their level of education when excess labour supply increases.

To the best of our knowledge, this study is the first to focus on individuals with the same level of education to investigate whether the protective effect of a higher level of skills against over-education and unemployment

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[1] See, in particular, Gautier et al. (2002), Devereux (2002), Gesthuizen and Wolbers (2010), Keane and Prasad (1993), Pollmann-Schult (2005), Teulings and Koopmanschap (1989) and Van Ours and Ridder (1995).

increases with the degree of over-supply in the labour market. For the purposes of our analysis, we use data from a survey of graduates conducted in 17 European countries;[2] these data contain skill measures and offer variation in labour market conditions across countries and fields of study. We examine whether the extent to which graduates' labour market risks are affected by their field-specific and academic skills depends on the ratio of labour supply to demand. By focusing on individuals at the upper end of the educational distribution around the time of their labour market entry, we are able to distinguish two risks associated with excess labour supply: the risk of over-education and the risk of unemployment. We examine field-specific and academic skills because these represent one of the most important skills dichotomies.[3]

This article contributes to the literature in two ways. First, we shed more light on the relationship between field-specific and academic skills and the labour market outcomes of graduates. Second, we analyse how the protective effect of field-specific and academic skills varies with the labour supply and demand ratio. In line with the predictions of the crowding-out hypothesis, we find that the level of protection afforded by field-specific skills against the risk of over-education is higher when the degree of excess labour supply in the occupational domain of the graduate's field of study is higher. Conversely, academic skills offer more protection against the risk of over-education when excess labour supply in the overall labour market is higher. Further, field-specific skills also protect graduates against the risk of unemployment, whereas graduates' level of academic skills appears to be unrelated to the risk of unemployment.

The remainder of this article is structured into five sections. The first presents our conceptual framework, and the second, our hypotheses. In the third section, we discuss our data and definitions, and in the fourth, we present our estimation results. The final section then sets forth our conclusions.

Conceptual framework

The crowding-out hypothesis is compatible with the job competition model (Thurow, 1975) and is based on the idea that when jobs become scarce, vacancies previously filled with low-skilled workers are filled with higher skilled workers, pushing the former into ever lower skilled jobs or even into unemployment. This process — also referred to as "skill bumping" (Borghans and de Grip, 2000) —

[2] Throughout this article, the term "graduates" refers to individuals who have graduated from a higher education institution, including both universities and universities of applied sciences.

[3] The economic literature usually distinguishes between firm-specific and general skills. While the former augment productivity only in a specific firm, the latter are productive across multiple firms. In our analysis of the labour market outcomes of graduates, the unit of analysis is the field of study rather than the firm. Following Heijke, Meng and Ris (2003), we therefore deviate from the standard dichotomy by referring to field-specific instead of firm-specific skills. We define field-specific skills as skills which are productive in jobs related to a graduate's field of study and which are transferable to the occupational domain of other fields of study only with considerable depreciation in value. Academic skills, on the other hand, are productive in all occupational domains and do not depreciate when transferred from one domain to another.

is likely to intensify with the degree of excess labour supply. There are several studies supporting this hypothesis. Devereux (2002) finds that the mean level of education of those employed in a particular occupation increases during recessions in the United States. Keane and Prasad (1993) show that workers with college degrees were protected from cyclical variation in employment in the United States in the 1970s. Pollmann-Schult (2005) finds evidence for crowding out in Germany in the period 1984–2000. For the Dutch labour market, Teulings and Koopmanschap (1989) find evidence for the crowding out of workers with lower levels of education by workers with higher levels of education during the recession of the 1980s. For the 1990s, Van Ours and Ridder (1995) and Gautier et al. (2002) suggest that crowding out might have been limited to university-educated versus higher professional-educated workers. Gesthuizen and Wolbers (2010) argue that over the period 1980–2004 in the Netherlands, crowding out resulted from higher education expansion rather than economic shocks.

In the above studies of cyclical crowding out, skills are defined as years of schooling or level of education. In our analysis, we use direct (self-assessed) measures of skill at the individual level. We are thus able to examine the risk of over-education and the risk of unemployment of higher education graduates with different skill endowments under different labour supply and demand ratios. We distinguish two types of skills, namely, field-specific skills and academic skills. These skill types have been shown to affect labour market entrants' risk of over-education as well as their risk of unemployment. Studies on labour market entrants at the intermediate education level emphasize the relevance of field-specific skills for labour market success (Bishop, 1995; Campbell and Laughlin, 1991; Goux and Maurin, 1994; Kang and Bishop, 1989; Mane, 1999; Payne, 1995; Ryan, 2001). Non-college-bound high school leavers with field-specific skills experience a smoother transition into work and higher earnings than their more generally educated counterparts. Yet, the situation may differ for higher-educated graduates. Heijke, Meng and Ris (2003) show that both field-specific *and* academic skills affect the labour market outcomes of graduates. High field-specific skills increase graduates' chances of getting a job in occupations related to their own field of study, which is on average associated with higher wages. Academic skills, by contrast, increase graduates' probability of receiving training during their first years in the labour market, which is also associated with higher wages. Both skill types, these authors conclude, therefore positively impact wages: field-specific skills, by securing a job related to the field of study, and academic skills, by increasing the incidence of training. However, Verhaest and van der Velden (2013) find that graduation from a study programme which is more focused on academic skills significantly increases the probability of being over-educated in the first job. But graduating from such general programmes also increases the probability of "escape" from a situation of over-education and finding a job which matches the level of education. These findings suggest that academic skills enable individuals to adapt to disequilibrium situations, such as working outside one's field of study or being over-educated for a given job.

In addition to distinguishing two types of skill, we differentiate between two labour market domains: the labour market specific to a field of study and the overall labour market (the "general labour market"). Specific labour markets refer to multiple, mutually exclusive occupational domains related to particular fields of study. We argue that graduates' prospects in the occupational domain related to their field of study are based on their level of field-specific skills. This labour market segment includes occupations which require a very specific set of skills, such as medical doctors, airline pilots, or engineers. In the occupational domain of a particular field of study, field-specific skills are the dominant factor for labour market success, because these are instantly deployable and are associated with low costs for further field-specific training. Alternatively, graduates can turn to the general labour market, say, when they are not able to find employment in the occupational domain related to their field of study. The general labour market segment comprises occupations that require graduates to have broadly applicable skills, such as the ability to think analytically. In the general labour market, competition for jobs is not limited to graduates of particular fields of study. Rather, all graduates can compete for these jobs. We argue that graduates' prospects in the general labour market are based on their academic skills because graduates' field-specific skills are not transferable to this segment. Examples of general jobs include trainee programmes in large firms, management positions, and general administrative positions.

Hypotheses

Even when unemployment is average, there will still be some degree of job–worker mismatch in terms of over-education, and a graduate's risk of becoming one of these mismatched workers will certainly depend on her or his level of skill. We therefore expect graduates with high levels of field-specific or academic skills to have a lower risk of landing a job for which they are over-educated than graduates with low levels of these skills (hypothesis 1).

The distinction between a labour market where more field-specific skills are required and a labour market where more academic skills are required has important implications for the formulation of our hypotheses with regard to the consequences of supply and demand shocks. Shocks taking place in the field-specific labour market will affect the relationship between field-specific skills and labour market outcomes, whereas shocks in the general labour market will affect the relationship between academic skills and labour market outcomes. When the number of graduates in a particular field of study increases relative to the number of tertiary-graduate-level jobs in the occupational domain related to that field, more graduates with low levels of field-specific skills will – in the event of an economic and/or demographic shock – be forced to take up jobs previously available for workers with intermediate qualifications for that field. The higher the excess labour supply in the field-specific labour market, the greater the difference will be in the risk of over-education between

graduates with high field-specific skills and graduates with low field-specific skills. We therefore expect the protective effect of field-specific skills against over-education to be higher when the degree of excess supply of graduates in the field-specific occupational domain is higher (hypothesis 2).

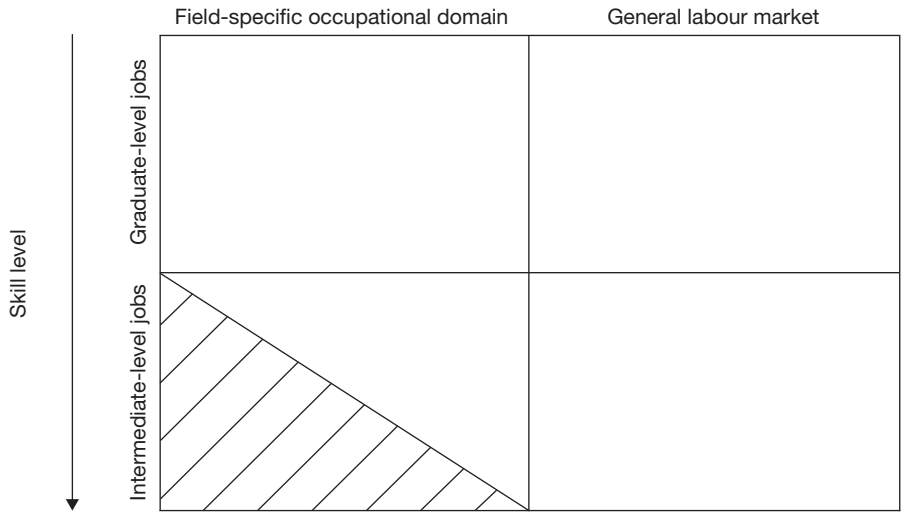
In the general labour market, employers prefer workers with the highest academic skills available. When jobs requiring higher education are scarce, therefore, graduates with lower levels of academic skills will accept jobs that would otherwise be available for workers with intermediate levels of education. We thus expect to observe a higher protective effect of academic skills against over-education when unemployment and competition for jobs in the general labour market are higher (hypothesis 3).

Let us now turn to the risk of unemployment. According to a strict interpretation of the crowding-out hypothesis, individuals with higher levels of education systematically possess higher and more productive skills than workers with lower levels of education. It will therefore always be attractive for firms to hire graduates for intermediate-level jobs – at the expense of workers with an intermediate level of education. Consequently, field-specific and academic skills would be relevant only to the distribution of graduates across job levels, but not to unemployment. However, this strict interpretation of the crowding-out hypothesis ignores that there may be other adjustment mechanisms. Wieling and Borghans (2001), for example, find that graduates' acceptance of jobs for which no tertiary-level degree is required is only one of the labour market's adjustment mechanisms. They also find that, for some specific fields of study, an increasing over-supply of graduates is associated with an increase in graduate unemployment. This is contrary to what we would expect if the higher educated were consistently higher skilled and better suited for jobs than the lower educated. Nickell and Bell (1995) suggest that high-skilled workers are only able to crowd out lower skilled workers if they can perform many of the tasks undertaken by the latter. This argument is key to formulating expectations about limitations to the crowding-out process in the two labour market segments we distinguish.

In contrast to academic skills, the field-specific skills of the higher educated do not necessarily substitute for the field-specific skills of the medium educated: being a good plumber requires different skills than developing and constructing domestic drainage systems. If the better jobs at the intermediate level are assigned to well-trained workers with intermediate levels of education, then some graduates – more precisely those whose level and nature of field-specific skills cannot compete with the level and nature of the field-specific skills of workers with intermediate levels of education – will not be able to find a job, or will not be able to find a job acceptable to them in terms of pay and job quality.[4] Consequently, graduates with low field-specific skills will be more likely to be unemployed than graduates with high field-specific skills,

[4] These graduates might opt for unemployment because they fear that accepting a low-skilled job signals low ability to potential future employers or because they find it more efficient to search for a better job while unemployed (Evans, 1999).

Figure 1. Four labour market segments and available jobs for graduates



as the latter will be able to find work at an adequately high level. These limitations to graduates' opportunity to crowd out the lower educated are less pronounced in the general labour market. In occupations which require academic skills, workers with intermediate levels of education can much more easily be replaced by graduates. In this labour market segment, it is indeed more attractive for firms to hire graduates instead of workers with intermediate levels of education, as graduates have "more of the same" skills. In the general labour market, jobs at the intermediate level are thus available for graduates, so that even the least skilled graduates have a high probability of finding acceptable employment in terms of pay and job quality (see figure 1).

Figure 1 illustrates how this conceptualization of the labour market for graduates might look. Graduates entering the labour market can potentially take jobs in two broad segments, which are in turn subdivided into two levels. Graduates can accept a graduate-level job related to the occupational domain of their field of study or outside this domain (i.e. in the general labour market). The same goes for intermediate-level jobs. Here, graduates can also take up a job related to the occupational domain of their field of study or in the general labour market. The downward arrow on the left side of the figure indicates the decreasing level of skill required of these workers. The argument here is that for some intermediate-level jobs in the field-specific occupational domain, the skills that higher-educated workers offer are not suitable (indicated by the diagonally striped area). In other words, these jobs are not available for graduates despite their higher level of education, leaving some graduates with low field-specific skills unemployed. We therefore expect that high field-specific skills also protect graduates against unemployment (hypothesis 4). Furthermore, we expect the protective effect of field-specific skills against unemployment to be higher when

excess supply of graduates in a given occupational domain is higher (hypothesis 5). The limitations to graduates' opportunities to crowd out lower-educated workers are expected to be far less pronounced in the general labour market. We therefore expect the protective effect of academic skills against unemployment to be significantly weaker than the protective effect of field-specific skills (hypothesis 6). However, here too we might expect the protective effect of academic skills against unemployment to be higher when excess supply of graduates in the general labour market is higher (hypothesis 7).

Data and definitions

Our analysis is based on original and representative data from the REFLEX and HEGESCO surveys of graduates in 17 European countries.[5] The questionnaire was sent to higher education graduates five years after their graduation. Our sample contains 11,552 individuals for the estimation of the probability of being unemployed, and 11,129 individuals for the estimation of the probability of being over-educated.

In the questionnaire, respondents were asked to rate their level of 19 different skills on a scale from 1 (very low) to 7 (very high). Two of these skills, "mastery of own field or discipline" and "analytical thinking" are used in this study as proxies for field-specific and academic skills, respectively. "Mastery of own field or discipline" refers to graduates' level of theoretical and practical knowledge in their own field and to the ability to apply this knowledge in practice. Analytical thinking, on the other hand, refers to the ability to generalize from a concrete problem to abstract ideas, and then to manipulate those ideas in order to arrive at a solution, not only to the original problem, but to a whole class of similar problems. These skills thus match our definitions of field-specific and academic skills quite well.

Our definition of the dependent variables is straightforward. We consider an individual unemployed if that individual was not in paid employment at the time of the survey and had been actively seeking such employment in the preceding four weeks. With regard to over-education, we asked respondents to indicate the type of education most appropriate to their job.[6] We consider graduates over-educated if the appropriate type of education for their job is below tertiary level.

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[5] The REFLEX survey (The Flexible Professional in the Knowledge Society) was conducted in 2005 in 15 European countries and Japan. The HEGESCO survey (Higher Education as a Generator of Strategic Competences) is the extension of REFLEX to four new EU Member States and Turkey, conducted in 2009. In our analysis, we focus only on European countries to ensure comparability. We exclude Sweden and Portugal because their survey designs substantially deviated from the other country surveys. For the selected countries, we include only individuals who were less than 36 years old at the time of the survey to limit the influence of unobserved pre-university labour market experience on our results. Moreover, we exclude all individuals who were not living or working in their home country at the time of the survey or who enrolled in further education after the initial education they reported on. The number of observations per country varies between 382 and 995.

[6] For a discussion on measurement issues in assessing over-education, see van der Velden and Van Smoorenburg (1997), Dolton and Vignoles (2000) and Hartog (2000).

Table 1. Overall graduate unemployment rates and unemployment rates in the occupational domain of particular fields of study per country

	Mean	ED	HU	SJI	BL	SMC	EMC	AV	HW	SE
Austria	4.3	2.4	6.1	4.4	4.5	3.6	3.2	5.8	4.8	3.7
Belgium	2.2	1.9	3.3	2.2	1.1	3.0	2.0	2.1	1.2	1.9
Czech Republic	2.6	3.1	3.9	1.6	1.9	2.6	2.1	2.5	2.6	2.1
Estonia	1.9	1.0	2.3	1.7	1.2	1.2	1.1	2.3	2.4	2.5
Finland	4.4	4.4	4.9	3.3	4.0	4.1	3.1	3.5	5.8	6.5
France	7.6	6.6	10.5	8.7	8.2	9.7	5.7	7.2	5.9	7.5
Germany	4.8	4.7	5.9	4.7	4.1	7.3	4.6	4.1	3.8	4.0
Hungary	5.0	6.7	4.2	5.3	4.9	4.6	4.5	4.9	4.1	5.9
Italy	7.6	9.0	10.2	9.1	7.4	8.4	3.6	8.1	6.6	7.4
Lithuania	3.2	3.8	4.4	2.7	2.7	2.8	2.7	—	2.9	3.0
Netherlands	4.2	2.6	6.0	4.0	3.6	6.1	3.5	4.7	2.8	4.1
Norway	2.7	2.4	3.3	3.0	2.1	2.5	2.2	2.6	2.1	3.1
Poland	2.2	3.3	2.0	1.5	2.1	2.3	1.7	2.0	1.8	1.8
Slovenia	3.8	3.9	4.1	3.3	3.6	3.5	2.4	5.1	1.6	5.4
Spain	8.9	9.8	12.5	9.9	7.8	10.3	5.1	11.3	7.5	8.0
Switzerland	4.4	3.6	5.2	5.3	4.2	6.4	3.2	4.3	3.1	—
United Kingdom	3.6	2.7	5.6	3.5	3.3	2.6	3.8	4.0	2.5	3.8

Notes: Values are posterior means derived from REFLEX/HEGESCO data. ED = Education, HU = Humanities and Arts, SJI = Social Sciences, Journalism and Information, BL = Business, Law, SMC = Science, Mathematics and Computing, EMC = Engineering, Manufacturing and Construction, AV = Agriculture and Veterinary, HW = Health and Welfare, SE = Services. "—" stands for "no observations".

Source: Authors' calculations based on REFLEX/HEGESCO data.

We use the unemployment rate among graduates at the time of the survey as a proxy for labour market conditions. In order to test our hypotheses, we include two different unemployment rates in our models, namely: the unemployment rate among graduates in the respondent's country, and the unemployment rate among graduates in the respondent's field of study in that country. The former is a good proxy for excess supply in the general labour market, as every unemployed graduate can compete for jobs in the general labour market. The latter is a proxy for excess supply in the occupational domain related to a particular field of study. Due to the specificity of skills required, only graduates in a particular field of study can enter competition for jobs in the occupational domain related to that field of study. Both unemployment rates are calculated on the basis of the combined REFLEX and HEGESCO data as posterior means.[7] Their values by country and field of study are displayed in table 1.

In our probit regressions, we include the unemployment rate in the occupational domain of a particular field of study (the field-specific unemployment

[7] When using posterior means instead of simple means, the mean country unemployment rate and the mean field-specific unemployment rate are corrected for reliability by shifting toward the "grand mean", depending on the number of observations within each country and field of study.

Table 2. Descriptive statistics of variables used in multivariate analysis (over-education model)

	Obs	% over-educated	Mastery of own field or discipline*		Analytical thinking*		Age		% female	% with higher educated father	% with study-relevant work experience during higher education	% with non-study-relevant work experience during higher education	% master's level degree
			mean	std.dev	mean	std.dev	mean	std.dev					
Austria	509	10.8	5.8	0.9	5.8	1.2	31.7	2.0	48.5	21.6	72.7	62.9	90.0
Belgium	449	2.7	5.2	0.9	5.4	1.1	28.2	1.2	51.9	47.0	19.8	58.4	57.9
Czech Republic	885	2.5	5.6	1.0	5.5	1.1	28.6	1.6	49.0	34.0	47.6	66.7	89.3
Estonia	362	1.7	5.0	0.9	5.3	1.1	30.0	1.9	67.4	58.0	56.4	39.0	11.6
Finland	779	6.8	5.0	1.0	4.9	1.2	30.5	2.0	56.7	21.2	68.0	51.7	48.4
France	544	5.1	5.1	1.0	5.2	1.0	28.2	1.8	70.0	39.9	60.1	57.0	38.8
Germany	680	5.9	5.8	0.9	5.6	1.2	31.7	1.8	46.8	59.1	58.2	48.1	59.0
Hungary	580	16.7	5.0	1.1	5.0	1.3	29.1	1.7	63.8	27.6	31.2	41.0	36.9
Italy	813	14.1	5.2	1.1	5.5	1.2	31.5	1.9	52.8	15.7	19.4	39.1	91.8
Lithuania	369	5.1	5.1	1.1	5.2	1.1	28.7	2.0	64.2	42.5	37.7	43.1	34.7
Netherlands	818	6.4	5.3	0.9	5.4	1.1	29.1	1.8	60.9	38.3	38.8	72.5	28.0
Norway	787	4.3	5.3	0.9	4.7	1.4	31.4	1.9	57.2	47.8	55.7	54.6	38.1
Poland	680	4.0	4.9	1.2	5.2	1.3	29.6	1.2	56.8	27.9	24.6	37.1	67.6
Slovenia	969	10.4	5.4	1.2	5.2	1.2	30.8	1.8	69.5	24.4	58.8	67.5	4.0
Spain	606	18.2	5.2	1.1	4.9	1.3	29.8	2.1	64.4	21.3	20.1	32.8	58.7
Switzerland	741	10.5	5.4	0.9	5.6	1.1	31.0	1.9	37.8	46.2	50.9	44.9	60.6
United Kingdom	558	17.2	5.1	1.1	5.3	1.2	27.5	1.6	56.6	33.0	18.5	42.1	6.3
Total	**11129**	**8.5**	**5.3**	**1.0**	**5.3**	**1.2**	**30.0**	**2.2**	**56.9**	**34.4**	**44.1**	**51.8**	**49.4**

Note: * z-scores used in the regressions.
Source: Authors' calculations based on REFLEX/HEGESCO data.

rate within a country) as the deviation from the overall unemployment rate (the country-level unemployment rate), and we include the overall country-specific unemployment rate as the deviation from the unemployment rate of the whole international sample. This ensures that the two unemployment rates are uncorrelated and brings advantages concerning the interpretation of the regression results, as pointed out in the next section. Note that using international variation for the identification of skill effects and their interaction with labour market conditions has advantages over national studies, but also obvious limitations. The main advantage is that measures generated from international data offer variation usually unavailable within a single country and provide insight into long-term, general equilibrium effects. A clear limitation of cross-country, cross-field evidence is the possible omission of country-level and field-level variables, such as institutional differences in ability sorting or employers' beliefs. This makes the identification of skill effects less clean than in studies exploiting changes within countries and fields over time.

As control variables, we use only variables which influence the probability of being over-educated or unemployed, because of signalling or network effects, but which are not necessarily outcomes of skills. We include sex, age, age squared, a dummy for whether the father has a higher education, a dummy for whether the respondent had a master's degree or equivalent,[8] a dummy for whether the respondent had study-related work experience during higher education, and a dummy for whether the respondent had non-study-related work experience during the higher education period. Descriptive statistics for all variables used in the multivariate analysis can be found in table 2.[9]

Estimation results and discussion

In this section, we present our estimation results using pooled probit models. For both dependent variables — i.e. the probability of being over-educated and the probability of being unemployed — we estimate three models.

In Model 1, the labour market mismatch, MM, of graduate i is estimated as follows:

$$\begin{aligned} MM_i^* &= \beta_{10} + \beta_{11} spec_i + \beta_{12} acad_i + \beta_{13} uf_{cf} + \beta_{14} uc_c + \beta_{15} X_i + \varepsilon_{1i} \\ MM_i &= 1[MM_i^* > 0] \\ \varepsilon_i &\sim N(0,1) \end{aligned} \qquad (1)$$

where MM_i is either 1 if unemployed or 1 if over-educated, depending on the mismatch examined; MM_i^* is the latent variable underlying the probabil-

[8] Note that the survey respondents completed their studies before the so-called Bologna process which aimed to harmonize higher education qualifications across Europe. Strictly speaking, we are talking about second-level higher education degrees at ISCED level 5A, allowing direct access to doctoral studies. For convenience, however, we refer to this as a master's degree or equivalent. The reference category is a degree at ISCED level 5A not offering direct access to doctoral studies (usually this is similar to a bachelor's degree).

[9] Additional models containing more individual and institutional control variables, such as the graduate's work experience, the country's employment protection legislation, and vocational specificity of the labour market, can be found in Appendix table A1.

ity of being unemployed or over-educated; $spec_i$ is the respondent's level of field-specific skills; $acad_i$ is the respondent's level of academic skills (analytical thinking); uf_{cf} is the unemployment rate in the occupational domain of the field of study, uc_c is the overall (country-level) unemployment rate; and X_i is our vector of controls.

Model 2 is our preferred model for testing our hypotheses. It is specified as:

$$MM_i^* = \beta_{20} + \beta_{21}spec_i + \beta_{22}acad_i + \beta_{23}uf_{cf} + \beta_{24}uc_c + \beta_{25}specxuf_i + \beta_{26}acadxuc_i + \beta_{27}X_i + \varepsilon_{2i} \quad (2)$$

Here, we additionally include the interaction term of field-specific skills with the unemployment rate in the occupational domain of the field of study, $specxuf_i$, as well as $acadxuc_i$, the interaction term of academic skills with the overall unemployment rate. Negative coefficient β_{21} in combination with negative coefficient β_{25} would indicate that the protective effect of field-specific skills against unemployment (or over-education) increases with the degree of excess supply of graduates in the occupational domain of the field of study. Negative coefficient β_{22} in combination with negative coefficient β_{26} would indicate that the protective effect of academic skills against unemployment (or over-education) increases with the degree of excess supply of graduates in the general labour market.

Model 3 includes two additional interaction terms between skills and unemployment rates; they test whether field-specific skills also interact with the overall unemployment rate, $specxuc_i$, and whether the effect of academic skills depends on field-specific labour market conditions, $acadxuf_i$.[10] This model is specified as:

$$MM_i^* = \beta_{30} + \beta_{31}spec_i + \beta_{32}acad_i + \beta_{33}uf_{cf} + \beta_{34}uc_c + \beta_{35}specxuf_i + \beta_{36}acadxuc_i + \beta_{37}specxuc_i + \beta_{38}acadxuf_i + \beta_{39}X_i + \varepsilon_{3i} \quad (3)$$

For the interpretation of the coefficients of the main effects of skills in Model 2, it is important to keep in mind that the unemployment rate in the occupational domain of a particular field of study is expressed as the deviation from the overall unemployment rate, and that the overall unemployment rate is expressed as the deviation from the unemployment rate of the whole sample. This means that the averages of these two variables are each zero. Consequently, the main coefficients of skills in Model 2 represent the effect of skills when the relevant unemployment rate is average.

Over-education

Table 3 presents the estimation results of the three models, with the probability of being over-educated for one's job five years after graduation as the dependent variable. Model 1 shows that, on average, both types of skills are

[10] We also ran all six models including field-of-study dummies; this did not substantially change the results.

Table 3. Probability of being over-educated five years after graduation

	Model 1	Model 2	Model 3
Mastery of own field (standardized)	–0.076*** (0.019)	–0.077*** (0.019)	–0.077** (0.019)
Analytical thinking (standardized)	–0.101*** (0.019)	–0.099*** (0.019)	–0.100 *** (0.019)
Overall unemployment rate	0.101*** (0.008)	0.098*** (0.008)	0.098*** (0.008)
Unemployment rate in occ. dom. of field of study	0.073*** (0.014)	0.070*** (0.014)	0.070*** (0.015)
Overall unemployment rate X Analytical thinking		–0.019** (0.008)	–0.021** (0.009)
Unemployment rate in occ. dom. of field of study X Mastery of own field		–0.030** (0.014)	–0.030** (0.015)
Unemployment rate in occ. dom. of field of study X Analytical thinking			–0.006 (0.015)
Overall unemployment rate X Mastery of own field			0.006 (0.009)
Controls included	yes	yes	yes
Pseudo R-squared	0.067	0.069	0.069
N	11 129	11 129	11 129

Notes: Reported coefficients are estimates from a pooled probit. Robust standard errors are given in parentheses. ***, ** and * indicate significance at the 1, 5 and 10 per cent levels, respectively. Controls included are sex, age, age squared, father having higher education, respondent having a second-level degree, study-related work experience during higher education, and non-study-related work experience during higher education.

Source: Authors' calculations based on REFLEX/HEGESCO data.

negatively related to the probability of being over-educated.[11] For the average person in our sample, a one-standard-deviation increase in field-specific skills reduces the risk of being over-educated by 1 percentage point, from 7.1 to 6.1 per cent; one standard deviation increase in academic skills reduces the risk of being over-educated by 1.4 percentage points, to 5.7 per cent (see Appendix table A2).

Both unemployment rates are positively related to the probability of being over-educated for one's job. Moreover, as expected, both the coefficient of the interaction of academic skills ("analytical thinking") with the overall unemployment rate and the coefficient of the interaction of field-specific skills ("mastery of own field") with the unemployment rate in the occupational domain of the field of study are negative and significant at the 5 per cent level in Model 2. This indicates that when the degree of excess supply of gradu-

[11] We also tested whether graduates working in jobs that match their level of education have higher skills because they receive more training than those who are over-educated (Van Smoorenburg and van der Velden, 2000). We therefore reran our estimation once with hours of training in the past weeks and once with a dummy indicating participation in training in the past 12 months to account for the effect of training on skills. Including these variables did not substantially change the coefficients of our variables of interest, indicating that our skill variables are not picking up training effects.

ates in the general labour market is higher, the protective effect of academic skills against the risk of over-education is also higher. Similarly, the protective effect of field-specific skills against the risk of over-education is higher when the excess supply of graduates in the occupational domain of the field of study is higher.

Table 4a (for field-specific skills) and table 4b (for academic skills) show the predicted probabilities of being over-educated for different skill levels and unemployment rates, holding all other variables fixed at their means. The difference in the probability of being over-educated between graduates with high and low levels of field-specific skills is smaller when the excess supply of graduates in the occupational domain of their field of study is lower. Similarly, the difference in the probability of being over-educated between graduates with high and low levels of academic skills is smaller when the overall excess supply of graduates is lower. Our estimation results therefore support our hypotheses 2 and 3.

Table 4a. Probability of over-education by level of field-specific skill and unemployment in occupational domain of field of study (other variables fixed at mean)

	Low field-specific skills (1 std. dev. below average)	High field-specific skills (1 std. dev. above average)	Difference
Low unemployment in occ. domain of a field of study (2% below average)	6.5	4.8	–1.7
Average unemployment in occ. domain of a field of study	8.5	6.4	–2.1
High unemployment in occ. domain of a field of study (2% above average)	11.1	8.4	–2.7

Note: This table shows the predicted probability of graduates being over-educated for their job five years after graduation, evaluated at different levels of field-specific skill and unemployment rates in the occupational domain of their field of study.

Source: Authors' calculations based on REFLEX/HEGESCO data.

Table 4b. Probability of over-education by level of academic skill and overall unemployment (other variables fixed at mean)

	Low academic skills (1 std. dev. below average)	High academic skills (1 std. dev. above average)	Difference
Low overall unemployment (2% below average)	6.3	4.2	–2.1
Average overall unemployment	9.2	6.3	–2.9
High overall unemployment (2% above average)	13.1	9.3	–3.8

Note: This table shows the predicted probability of graduates being over-educated for their job five years after graduation, evaluated at different levels of academic skill and overall unemployment rates.

Source: Authors' calculations based on REFLEX/HEGESCO data.

Model 3 shows that the interaction term of field-specific skills and the overall unemployment rate, as well as the interaction term of academic skills and unemployment in the occupational domain of the field of study, are not statistically significant. This suggests that fluctuations of the unemployment rate in one labour market segment do not affect job competition in the other. In other words, the level of protection against the risk of over-education afforded by field-specific skills does not depend on the overall excess supply of graduates. Likewise, the level of protection against the risk of over-education afforded by academic skills does not vary with the degree of excess supply of graduates in the occupational domain of the field of study.

Unemployment

Table 5 presents the estimation results for the probability of being unemployed five years after graduation. The estimation results of Model 1 show that graduates who have high field-specific skills have a lower probability of being unemployed than those with a lower level of field-specific skills. For the average person in our sample, a one standard deviation increase in field-specific skills lowers the chance of being unemployed by 0.8 percentage points to 2.2 per cent (see Appendix table A2). This finding confirms our hypothesis 4

Table 5. Probability of being unemployed five years after graduation

	Model 1	Model 2	Model 3
Mastery of own field (standardized)	–0.124*** (0.025)	–0.128*** (0.025)	–0.128*** (0.025)
Analytical thinking (standardized)	0.029 (0.024)	0.026 (0.024)	0.025 (0.025)
Overall unemployment rate	0.088*** (0.011)	0.089*** (0.011)	0.089*** (0.011)
Unemployment rate in occ. dom. of field of study	0.167*** (0.019)	0.168*** (0.019)	0.169*** (0.019)
Overall unemployment rate X Analytical thinking		0.014 (0.010)	0.011 (0.012)
Unemployment rate in occ. dom. of field of study X Mastery of own field		0.016 (0.018)	0.012 (0.019)
Unemployment rate in occ. dom. of field of study X Analytical thinking			0.008 (0.020)
Overall unemployment rate X Mastery of own field			0.005 (0.011)
Controls included	yes	yes	yes
Pseudo R-squared	0.068	0.068	0.068
N	11 552	11 552	11 552

Notes: Reported coefficients are estimates from a pooled probit. Robust standard errors are given in parentheses. ***, ** and * indicate significance at the 1, 5 and 10 per cent levels, respectively. Controls included are sex, age, age squared, father having higher education, respondent having a second-level degree, study-related work experience during higher education, and non-study-related work experience during higher education.

Source: Authors' calculations based on REFLEX/HEGESCO data.

with regard to the protective effect of field-specific skills against unemployment. However, neither in Model 2 nor in Model 3 are the coefficients of the interaction terms statistically significant. We thus find no support for hypothesis 5, according to which the protective effect of field-specific skills against the risk of unemployment was expected to vary with excess supply of graduates in the occupational domain of the field of study.

Further, the effect of academic skills on the probability of being unemployed five years after graduation is insignificant, which supports our hypothesis 6. Moreover, we do not find that the effect of academic skills is related to either of the two unemployment rates. We thus find no evidence in support of hypothesis 7. These results suggest that firms are always better off hiring graduates — instead of workers with intermediate levels of education — for jobs which require academic skills.

Conclusion

This article has focused on two dimensions of the crowding-out hypothesis by investigating the relationship between graduates' skills and the risk of being employed in a job for which no tertiary degree is required, or being unemployed. To do so, we established a conceptual framework in which two labour market segments are distinguished, namely: a segment where field-specific skills determine the allocation of graduates to jobs (the occupational domain of a particular field of study), and a segment where academic skills determine the allocation of graduates to jobs (the general labour market). Overall, we find that competition for graduate jobs is related to skills, and this relationship is more intensive when the degree of excess supply of graduates is higher.

In line with the crowding-out hypothesis, we find that the protective effect of field-specific skills against the risk of over-education depends on the degree of excess supply of graduates in the occupational domain of the corresponding field of study, and that the protective effect of academic skills against over-education depends on the degree of excess supply of graduates in the general labour market.

Using a conceptual framework which deviates from strict interpretation of the crowding-out hypothesis, and which incorporates the idea that the substitutability of the field-specific skills of graduates and the field-specific skills of workers with intermediate levels of education is subject to substantial limitations, we find that graduates with low field-specific skills have a higher probability of being unemployed than graduates with high field-specific skills. We do not find this effect for academic skills. This supports the idea that the field-specific skills of graduates and lower-educated workers really differ in nature, whereas the academic skills of graduates versus lower-educated workers can be characterized as "more of the same".

The results of this study are encouraging and provide new insights into the workings of the labour market for graduates. We realize, however, that

using cross-sectional data to test our conceptual framework can only be a first step. Further research exploiting cyclical variation within fields and within countries over time is needed to establish causality more conclusively.

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Appendix

Table A1. Probability of being over-educated, extended set of control variables

DV: Over-educated five years after graduation	Model 1	Model 2	Model 3
Female	0.115*** (0.038)	0.117*** (0.038)	0.118*** (0.038)
Age	–0.119 (0.190)	–0.096 (0.190)	–0.093 (0.191)
Age squared	0.003 (0.003)	0.002 (0.003)	0.002 (0.003)
Father with higher education	–0.154*** (0.040)	–0.156*** (0.040)	–0.155*** (0.040)
Master's level degree	–0.382*** (0.039)	–0.382*** (0.039)	–0.382*** (0.039)
Study-related work during higher education	–0.226*** (0.038)	–0.226*** (0.038)	–0.226*** (0.038)
Non-study-related work during education	0.077** (0.036)	0.073** (0.036)	0.073** (0.036)
Months employed since graduation	–0.008*** (0.001)	–0.008*** (0.001)	–0.008*** (0.001)
Vocational orientation (country)	0.091* (0.048)	0.093* (0.048)	0.093* (0.048)
Employment protection legislation (country)	–0.255*** (0.030)	–0.255*** (0.030)	–0.256*** (0.030)
Mastery of own field (standardized)	–0.073*** (0.020)	–0.074*** (0.020)	–0.074*** (0.020)
Analytical thinking (standardized)	–0.099*** (0.019)	–0.097*** (0.019)	–0.097*** (0.019)
Overall unemployment rate	0.104*** (0.010)	0.101*** (0.010)	0.101*** (0.010)
Unemployment rate in occ. dom. of field of study	0.061*** (0.014)	0.058*** (0.015)	0.057*** (0.015)
Overall unemployment rate x Analytical thinking		–0.021** (0.009)	–0.023** (0.009)
Overall unemployment rate x Mastery of own field		–0.032** (0.014)	–0.032** (0.015)
Unemployment rate in occ. dom. of field of study X Analytical thinking			–0.006 (0.015)
Unemployment rate in occ. dom. of field of study X Mastery of own field			0.008 (0.009)
Constant	0.830 (2.859)	0.492 (2.867)	0.441 (2.867)
Pseudo-R-squared	0.082	0.084	0.084
N	11 129	11 129	11 129

Notes: Reported coefficients are estimates from a pooled probit. Robust standard errors are given in parentheses. ***, ** and * indicate significance at the 1, 5 and 10 per cent levels, respectively. The vocational orientation index was created by calculating the country average of the vocational orientation of the study programme variable. This worked better than the official OECD statistic referring to the percentage of students in vocational education.

Source: Authors' calculations based on REFLEX/HEGESCO data.

Table A2. The effect of a one standard deviation increase in the level of skills on the probability of being unemployed or over-educated (marginal effect)

	Marginal effect
Unemployment	
Mastery of own field (standardized)	–0.008*** (0.002)
Analytical thinking	0.002 (0.002)
Over-education	
Mastery of own field (standardized)	–0.010*** (0.003)
Analytical thinking (standardized)	–0.014*** (0.002)
Overall unemployment rate X Analytical thinking	–0.005*** (0.001)
Field-specific unemployment rate X Mastery of own field	–0.005*** (0.002)

Notes: All marginal effects are calculated on the basis of the pooled probit procedure used for producing tables 2 and 3. The marginal effects of the interaction terms were calculated using the Ai and Norton (2003) inteff stata programme. Controls included are a dummy for being female, age, age squared, a dummy equal to one if father has higher education, a dummy equal to one if respondent has a master's level degree, a dummy equal to one if respondent had study-related work experience during higher education, and a dummy equal to one if respondent had non-study-related work experience during higher education.

*** Statistically significant at the 1 per cent level.

Source: Authors' calculations based on REFLEX/HEGESCO data.